140810180035 – hanifdwiprasetiyo

——

Kasus 1 Merge Sort

```
/*
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MergeSort
*/

#include <iostream>
#include <chrono>

using namespace std;

void satu(int* in, int p, int q,int r){
    int n1 = q-p+1;
    int n2 = r-q;
    int L[n1+1];
    int R[n2+1];
    for (int i=1; i<=n1; i++){
        L[i-1] = in[(p-1)+i-1];
    }
    for (int j=1; j<=n2; j++){
        R[j-1] = in[(q-1)+j];
    }
    int i=0;
    int j=0;
    L[n1]=2147483647;
    R[n2]=2147483647;
    for (int k=(p-1); k<r; k++){
        if(L[i]<=R[j]){
            in[k]=L[i];
            i = i+1;
        }
        else{
            in[k]=R[j];
            j = j+1;
        }
    }
}

void msort(int* in, int p, int r){
    int q;
    if(p<r){
        q = (p+r)/2;
        msort(in, p, q);
        msort(in, q+1, r);

        satu(in, p, q, r);
    }
```
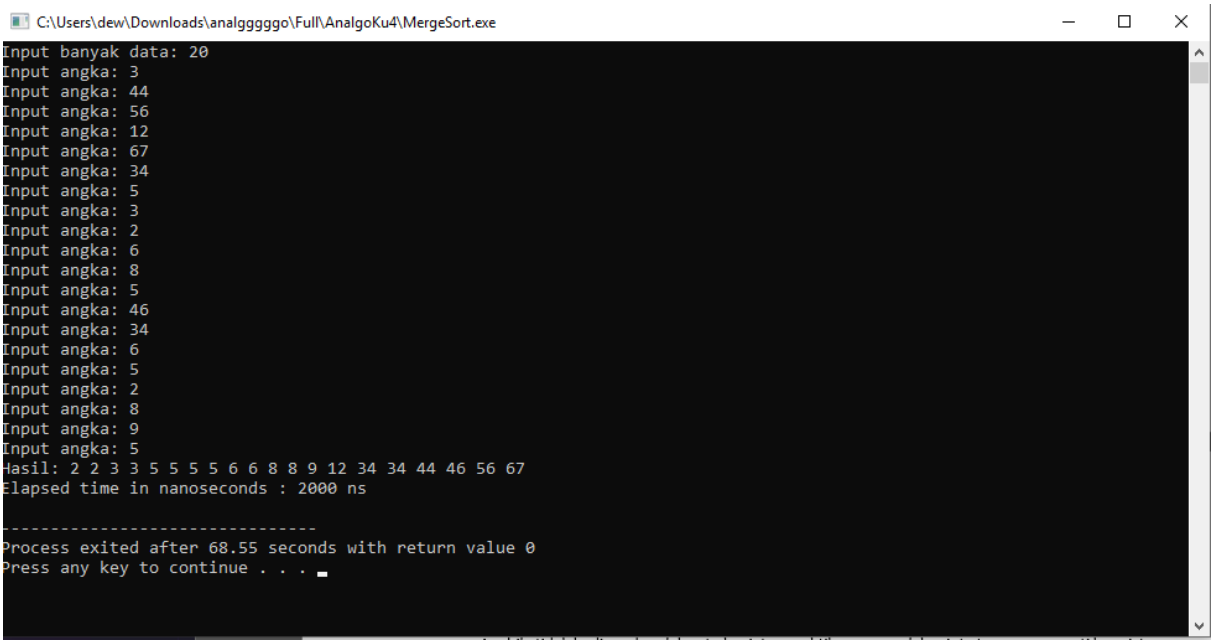

```
}

void input(int* a, int& n){
    cout<<"Input banyak data: ";cin>>n;
    for (int i=0; i<n; i++){
        cout<<"Input angka: ";cin>>a[i];
    }
}

int main(){
    int in[100];
    int n;
    input(in,n);
    auto start = chrono::steady_clock::now();
    msort(in,1,n);
    auto end = chrono::steady_clock::now();
    cout<<"Hasil: ";
    for(int i=0; i<n; i++){
        cout<<in[i]<<" ";
    }
    cout<<endl;
    cout << "Elapsed time in nanoseconds : "
        << chrono::duration_cast<chrono::nanoseconds>(end - start).count()
        << " ns" << endl;

    return 0;
}
```



Kompleksitas Algoritma merge sort adalah O(n lg n). Cari tahu kecepatan komputer Anda dalam memproses program. Hitung berapa running time yang dibutuhkan apabila input untuk merge sort-nya adalah 20?

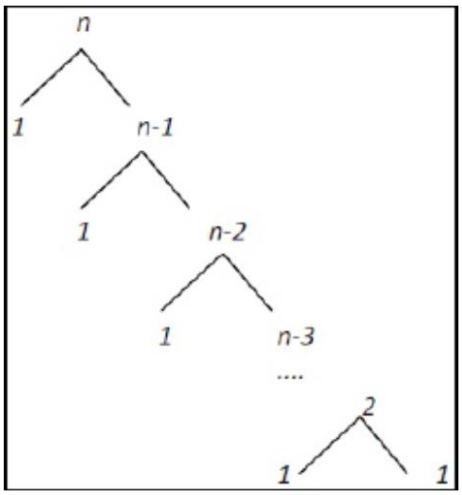
Untuk di program hasilnya : 2 microseconds
Tapi jika sesuai dengan O -> $T(20 \log_{10} 20) = 26$

Kasus 2 Selection Sort:

```
for i ← n downto 2 do {pass sebanyak n-1 kali}
    imaks ← 1
    for j ← 2 to i do
      if xj > ximaks then
        imaks ← j
      endif
    endfor
    {pertukarkan ximaks dengan xi}
    temp ← xi
    xi ← ximaks
    ximaks ← temp
endfor
```

Subproblem = 1
Masalah setiap subproblem = n-1
Waktu proses pembagian = n
Waktu proses penggabungan = n

$T(n) = \{\Theta(1)\, T(n-1) + \Theta(n)$




```
T(n) = cn + cn-c +cn-2c + ..... + 2c +cn
   = c((n-1)(n-2)/2) + cn
   = c((n^2-3n+2)/2) + cn
   = c((n^2)/2)-(3n/2)+1 + cn
   =O(n^2)

T(n) = cn + cn-c +cn-2c + ..... + 2c +cn
   = c((n-1)(n-2)/2) + cn
   = c((n^2-3n+2)/2) + cn
   = c((n^2)/2)-(3n/2)+1 + cn
   = Ω (n^2)

T(n) = cn^2
   = Θ(n^2)
```

SC

```
/*
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```

```
SelectionSort
*/
#include <iostream>
using namespace std;

struct masukan{
    int in;
    masukan* next;
    masukan* previous;
};

masukan* input(){
    int x;
    masukan* in=NULL;
    masukan* test=NULL;
    cout<<"Input banyak data: ";cin>>x;
    for (int i=0; i<x; i++){
        if(in==NULL){
            in = new masukan;
            cout<<"Input angka: ";cin>>in->in;
            in->next=NULL;
            in->previous=NULL;
            test=in;
            continue;
        }
        else if(test->next==NULL){
            test->next=new masukan;
            cout<<"Input angka: ";cin>>test->next->in;
            test->next->previous=test;
            test->next->next=NULL;
        }
        test=test->next;
    }
    return in;
}

void urut(masukan*& in){
    masukan* test1=in;
    masukan* test2;
    masukan* x;
    while(test1->next!=NULL){
        test1=test1->next;
    }
    while(test1!=NULL){
        x=in;
        test2=in->next;
        while(test2!=test1->next){
            if(test2->in>x->in){
                x=test2;
            }
            test2=test2->next;
        }
```

```
        swap(test1->in,x->in);
        test1=test1->previous;
    }
}

int main(){
    masukan* in;
    masukan* sort;
    in=input();
    urut(in);
    masukan* test=in;
    cout<<"Data yang sudah terurut: ";
    while(test!=NULL){
        cout<<test->in<<" ";
        test=test->next;
    }
    cout<<"\n";
    system(“read a”);
    return 0;
}
```

Kasus 3 Insertion Sort:

Algoritma

```
for i ← 2 to n do
    insert ← xi
    j ← i
    while (j < i) and (x[j-i] > insert) do
        x[j]← x[j-1]
        j←j-1
    endwhile
    x[j] = insert
endfor
```

Subproblem = 1
Masalah setiap subproblem = n-1
Waktu proses penggabungan = n
Waktu proses pembagian = n

$T(n) = \{\Theta(1)\ T(n-1) + \Theta(n)$

T(n) = cn + cn-c +cn-2c + ... + 2c +cn <= 2cn^2 + cn^2
= c((n-1)(n-2)/2) + cn<= 2cn^2 + cn^2
= c((n^2-3n+2)/2) + cn<= 2cn^2 + cn^2
= c((n^2)/2)-c(3n/2)+c+cn <= 2cn^2 + cn^2
=O(n^2)

T(n) = cn <= cn
= Ω (n)

T(n) = (cn + cn^2)/n
= Θ(n)

SC

```
/*
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Insertion Sort
*/
#include <iostream>
using namespace std;

struct masukan{
    int in;
    masukan* next;
    masukan* previous;
};

masukan* input(){
    int x;
    masukan* in=NULL;
    masukan* test=NULL;
    cout<<"Input banyak data: ";cin>>x;
```

```
    for (int i=0; i<x; i++){
        if(in==NULL){
            in = new masukan;
            cout<<"Input angka: ";cin>>in->in;
            in->next=NULL;
            in->previous=NULL;
            test=in;
            continue;
        }
        else if(test->next==NULL){
            test->next=new masukan;
            cout<<"Input angka: ";cin>>test->next->in;
            test->next->previous=test;
            test->next->next=NULL;
        }
        test=test->next;
    }
    return in;
}

void urut(masukan*& in){
    masukan* test1=in;
    masukan* test2;
    while(test1->next!=NULL){
        test2=test1->next;
        while(test2->previous!=NULL && test2->in<test2->previous->in){
            swap(test2->in,test2->previous->in);
            test2=test2->previous;
        }
        test1=test1->next;
    }
}

int main(){
    masukan* in;
    masukan* sort;
    in=input();
    urut(in);
    masukan* test=in;
    cout<<"Data yang sudah terurut: ";
    while(test!=NULL){
        cout<<test->in<<" ";
        test=test->next;
    }
    cout<<"\n";
    system("read a");
    return 0;
}
```

Kasus 4 Bubble Sort:

Subproblem = 1
Masalah setiap subproblem = n-1
Waktu proses pembagian = n
Waktu proses penggabungan = n

$$T(n) = \{\Theta(1)\ T(n-1) + \Theta(n)$$

T(n) = cn + cn-c +cn-2c + ... + 2c +c <= 2cn^2 + cn^2
= c((n-1)(n-2)/2) + c<= 2cn^2 + cn^2
= c((n^2-3n+2)/2) + c<= 2cn^2 + cn^2
= c((n^2)/2)-c(3n/2)+2c <= 2cn^2 + cn^2
=O(n^2)

T(n) = cn + cn-c +cn-2c + ... + 2c +c <= 2cn^2 + cn^2
= c((n-1)(n-2)/2) + c<= 2cn^2 + cn^2
= c((n^2-3n+2)/2) + c<= 2cn^2 + cn^2
= c((n^2)/2)-c(3n/2)+2c <= 2cn^2 + cn^2
= Ω (n^2)

T(n) = cn^2 + cn^2
= Θ(n^2)

SC

```c
/*
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Bubble Sort
*/
#include <stdio.h>

void swap(int *xp, int *yp)
{
    int temp = *xp;
    *xp = *yp;
    *yp = temp;
}

void bubbleSort(int arr[], int n)
{
   int i, j;
   bool swapped;
   for (i = 0; i < n-1; i++)
   {
     swapped = false;
     for (j = 0; j < n-i-1; j++)
     {
        if (arr[j] > arr[j+1])
        {
           swap(&arr[j], &arr[j+1]);
           swapped = true;
```

```
        }
     }

     // IF no two elements were swapped by inner loop, then break
     if (swapped == false)
        break;
   }
}

void printArray(int arr[], int size)
{
    int i;
    for (i=0; i < size; i++)
        printf("%d ", arr[i]);
    printf("n");
}

int main()
{
    int arr[] = {64, 34, 25, 12, 22, 11, 90};
    int n = sizeof(arr)/sizeof(arr[0]);
    bubbleSort(arr, n);
    printf("Sorted array: \n");
    printArray(arr, n);
    return 0;
}
```